route, returning by New Zealand, Samoa, the Sandwich Islands, San Francisco, and New York. The observations relate principally to barometrical heights, temperature of air and sea, moisture of the atmosphere, and twilight phenomena, including zodiacal light, whilst passing through the Red Sea and tropical portions of the Indian and Pacific Oceans.

Although in previous yearly Reports Dr. Neumayer has published much information respecting the internal working, aims, and results of the Observatory he so ably directs, it is only from the perusal of this seventh Report that a full idea of the pains which Germany has taken on behalf of her sea-going population, in building and equipping at considerable expense the noble Naval Observatory at Hamburg, can be obtained. It should also be remembered that there are several minor affiliated institutions in Germany of like intent.

THE INSTITUTION OF MECHANICAL ENGINEERS

AT the recent meeting of the Institution of Mechanical Engineers, held in Leeds under the presidency of Mr. Jeremiah Head, a paper was read "On Triple-Expansion Marine Engines," by the late Mr. Robert Wyllie of Hartlepool. During the last few years the high-pressure triple-expansion engine has proved the successful rival of the double-expansion compound, and the object of the paper was to bring forward the results of recent experience with this new type of engine, and to consider briefly the various points which have a direct bearing on its efficiency, as well as the most suitable design for marine purposes. The general conditions of efficiency were stated to depend on the approximate equality in the range of temperature in each cylinder, in the initial stress on each crank, and in the indicated horse-power of each engine. As complementary to these are steam-jacketed cylinders and other matters which are first treated of. As regards steam-jackets, when in triple-expansion engines attention is paid to the equal division of the total range of temperature amongst the cylinders in which the successive stages of expansion take place, the benefits arising from the use of steam-jackets are naturally not so great as in single-cylinder engines with a high rate of expansion; but however carefully the triple engine may be designed, the jacketing of at least the intermediate and low-pressure cylinders is essential to maximum efficiency. The ratio of the cylinder capacities depends on the pressure of the steam and type of engine, the high-pressure cylinder being larger in proportion where large range of power and economy of fuel is not so important, as in war-ships as compared with cargo steamers. To obtain even approximate equality in powers, temperatures, and stresses requires the greatest care in designing the steam-passages throughout the engine, so that the velocities of the steam at the various points and the degrees of cut-off by the valves may be carefully proportioned. Too much care cannot be taken in the design of the steam-ports and exhaust-passages of the low-pressure cylinder. The ports should be as small as possible to reduce the clearance to a minimum, and the speed of the entering steam should not be so high as to cause excessive frictional resistance, nor that of the exhaust so high as to augment the back-pressure, and consequently the greatest efficiency is obtained when the revolutions and indicated horse-power are not required to vary to any great extent. Contracted or indirect exhaust-passages in the high-pressure and intermediate cylinders have the effect of causing a larger difference between the back-pressure on one piston and the initial pressure on the next, thus diminishing the efficiency of the steam. The cut-off necessary for the highest efficiency is governed to a great extent by the speed of the entering steam and the nature of the passages. In the intermediate and low-pressure cylinders, too high a velocity of the entering steam will produce excessive frictional resistance, causing a drop in the expansion-curve, as well as unduly high receiver-pressure, thus disturbing the equality of temperatures and of initial stresses. Some diversity of opinion has existed as to the order of sequence for the three cranks. The author considered the best sequence to be the high-pressure leading, low-pressure following, and intermediate last. As regards the number of cranks, the best design is to have two cylinders on each crank for a two-crank engine on the triple-expansion system, as it is then possible to get an approximately equal initial stress on each crank, the arrangement necessitating one of the three stages of expansion taking place in two cylinders instead of in one. A marine engine should be so designed that any working part can be easily examined or removed, the arrangement of cylinders on three cranks fulfilling the required conditions more nearly than any other design. The requirements of a good valve-gear are, that it shall give at both ends of the cylinder an equal distribution of steam at all grades of expansion, with a minimum of working parts and no undue strains. The four principal methods are: by the single eccentric, by the double eccentric, by taking the motion from the connecting-rod, and by a compound motion derived from both the piston-rod and the connecting-rod; all have their advantages and defects, and vary considerably in complexity and multiplicity of parts. A comparison of practical results with compound- and triple-expansion engines is in favour of the latter, as regards dead-weight carried, speed, indicated horse-power, and coal-consumption, the latter being so low as 1·41 lbs. per h.p. per hour, proving this class of engine to be most efficient. The paper concluded with a reference to artificial draught for boilers, in the special arrangement described the air being heated both inside and outside the uptake, balanced fire doors being applied, which on being opened shut off automatically the hot air supplied by the fan both above and below the fire-bars.

An important discussion followed the reading of the paper. Mr. Wm. Parker, of Lloyd's, looked upon the triple-expansion engine as the engine of the future. Profs. Kennedy and Smith drew attention to the high initial pressures employed in the triple engine, 150 lbs. per square inch as compared with 75 lbs. per square inch in the compound engines being the cause of their higher efficiency; and other speakers having drawn attention to special features in the designs, the further discussion of the paper was put off to the spring meeting of the Institute.

Afterwards the President, by request, declared the Leeds Engineering School of the Yorkshire College open, and spoke in hopeful terms of the useful work it had doubtless before it.

NOTES

WE regret to have to announce the death last week of Dr. Guthrie, Professor of Physics at the Normal School of Science.

WE understand that the Jardin des Plantes has acquired for its botanical collections the herbarium of Lamarck. We do not know under what circumstances this had travelled so far from France. But until recently it was the property of Dr. Roeper, Professor of Botany in the University of Rostock. He incorporated it with his own herbarium, and the whole was purchased at his death by the University for 21,000 marks (1050*l.*). Lamarck's plants have however been separated, and as we understand purchased by the French Government.

THE front and sides of the new building for the galleries of natural history in the Jardin des Plantes are now nearly complete. But it will be two years or nearly so before the interior and the fittings can be finished. The collections will then be moved into the new portion, and the present galleries rebuilt to form the back of the square. The hollow interior will be covered with a glass roof, and will thus be available for the reception of large objects. In the new front the mammals will occupy the ground-floor and the birds the gallery above.

THE French National Museum has received a valuable collection of mammals obtained during M. de Brazza's recent expedition in the Congo district. In it are examples of two new and well-marked species of monkeys of the genus *Colobus*, and specimens of a very fine new *Cercopithecus*, allied to *C. diana*, which M. Milne-Edwards has named *C. brazzæ*. There are also examples of several other mammals of considerable interest. Looking at these discoveries and others recently made in Somaliland, it is evident that the mammal-fauna of Africa is by no means yet exhausted.

THE experiment has been tried at the Finsbury Technical College of giving free Saturday evening popular lectures and of afterwards allowing the visitors to see over the laboratories and workshops. The lectures were given by the Professors of the College on the following dates:—October 2, Prof. S. P. Thompson, D.Sc., on "Waves of Light"; October 9, Prof. J. Perry, F.R.S., on "Spinning Tops"; October 16, Prof. R. Meldola, F.R.S., on "Coal, and what we get out of it." The concluding lecture was given on Saturday last, October 23, by Prof. Thompson, on "Magnets and Electro-magnets," the Lord Mayor taking the chair for the occasion. The numbers of visitors filling the lecture theatres on these occasions show that the movement has been appreciated by the public.

PROF. FREDERICK McCOY, of the University of Melbourne, has been appointed a Companion of the Order of St. Michael and St. George.

WE are glad to hear that the completed volume of the "Zoological Record" may be expected before the end of the year; the reports on mammals, birds, and reptiles were issued to subscribers six weeks ago, and those on insects are now ready.

TWO new botanical journals have recently made their appearance in Italy, named—according to the fashion of *Linnæa*, *Grevillea*, and *Hedwigia*—after the two distinguished botanists De Notaris and Malpighi. Three quarterly numbers have now been published of *Notarisia*, a journal devoted to the interests of phycology, issuing from Venice, and edited by Sigg. De Toni and Levi. A very useful feature in this publication is the list, in each number, of the phycological literature, and the descriptions of all new species published during the quarter. *Malpighia*, of which the first monthly number is issued, edited by Sigg. Borzi, Penzig, and Pirotta, and published at Messina, is of a more general character. Besides reviews, short notices, and a bibliography, it contains articles "On the Atomic Weights of Living Things," by L. Errera; "On the Structure of the Nectaries of *Erythronium dens canis*," by S. Calloni; "On Soredial Sporidia of *Amphiloma murorum*," by A. Borzi; and "Researches on a Species of *Aspergillus*," by F. Morini.

A CURIOUS custom of the natives of Java in the neighbourhood of the Bromo volcano is recorded in the *Straits Times* of Singapore. It is said that whenever an eruption takes place, the natives, as soon as the fire (the molten lava no doubt is meant) comes down the mountain, kindle at it the wood they use as fuel for cooking. They keep in the fire thus made for years, and whenever it goes out through neglect, or for any other reason, they never kindle it anew from matches, but they get a light from their nearest neighbours, whose fire was originally obtained from the volcano. The fires in use up to the late outburst in the native cooking-places were all obtained from the Bromo eruption of 1832.

THE issue for last year (No. 16) of the *Journal* of the Straits Branch of the Royal Asiatic Society does not contain much of specially scientific interest, although there are interesting papers on various subjects connected with the Malay Peninsula. Mr. Perham translates a very old and popular Dyak myth, and Mr. Hale, Inspector of Mines at Kinta in Perak, writes on mines and miners there. Some of the customs described are very curious. The Malay miner, the writer says, has peculiar ideas about tin and its properties. He believes that it is under the protection and command of certain spirits whom he considers it necessary to propitiate. He thinks the tin itself is alive and has many of the properties of living matter, that of its own volition it can move from place to place, that it can reproduce itself, and that it has special likes and dislikes towards certain persons and things. Hence he thinks it advisable to treat tin-ore with a certain amount of respect, to consult its convenience, and to conduct the business of mining in such a way that the tin-ore may, as it were, be obtained without its own knowledge. There is also an interesting vocabulary of the language of the Sulu archipelago, which is said to be a variety of the Bisaya of the Philippines.

ON Saturday M. Miclucho Maclay opened at St. Petersburg his small exhibition of ethnological objects from New Guinea and the Malay Archipelago in one of the halls of the Academy of Sciences, and delivered a lecture on Russian colonisation in New Guinea to the assembled visitors.

THE International Congress of Hydrology and Climatology met at Biarritz in the first week of October under the presidency of M. Durand Fardel. The number of members reached from 800 to 900.

THE National Fish Culture Association are constructing a new hatchery, and making other improvements at their establishment at Delaford Park, towards the expense of which they have received 200 guineas from the Fishmongers' Company. Donations have also been received from the Duke of Bedford, the Marquess of Exeter, Sir Albert K. Rollit, Mr. Mann, and others, towards the same object.

WE have received the report of the West Kent Natural History, Microscopical, and Photographic Society for the past year. The Presidential Address by the Rev. Andrew Johnson dealt mainly with the progress made in one branch of mycological science, the *Agaricini*, during the last twenty years, starting from the publication of Berkeley's "Outlines of British Fungology," local Societies such as this are, we think, best judged by the local work they do, not by the lecturers they may succeed in getting to address them. Good-natured scientific men of eminence who will consent to address local Societies can be obtained without very great difficulty if approached in the proper way, but to have good local papers a Society must have local members capable of good steady scientific work. In this respect the West Kent Society is not wanting, for the principal paper in this report is one by Mr. Spurrell, entitled "A Sketch of the History of Rivers and Denudation of West Kent," which is an exhaustive account of the geology of the neighbourhood, which may be presumed to be specially within the scope of the Society's work. It occupies about fifty pages, and has a considerable number of plates and illustrations.

FROM the Report for 1885 of the Australian Museum, Sydney, we learn that the Museum is open to the public from 10 until 5 o'clock (or in summer till 6 o'clock) on week-days, on Sundays from 2 o'clock to 5. The largest attendance on any one day was 1686. The greatest Sunday attendance was 1230. The average daily number of visitors throughout the year was 264 on week-days and 844 on Sundays. The total for the year was 126,512. The collections are still being increased, by means of purchases, exchanges, and donations; also by collecting and dredging expeditions. A list of these additions, under separate heads, is given in appendixes. Among these may be specially mentioned presentations in exchange from the Royal Museum at Florence; about 2000 Indian fishes from Dr. Day; three whales, caught on the coast of New South Wales; and sundry specimens of ethnology from the South Sea Islands, casts of natives of Micronesia and Polynesia, from Dr. Finsch, &c. A compass and collecting-jar belonging to Capt. Cook, purchased by the Agent-General and presented by the Colonial Secretary, are not without interest. Great alterations and improvements are still in progress, by the erection of additional glass cases. It is contemplated shortly to re-fit the old wing of the Museum with cases suitable for the mineralogical collections, which will then be exclusively placed there. Rooms have been fitted up for the osteological collections, which are now being removed thither from other parts of the building. The want of sufficient space in the present building for the constantly-increasing number of exhibits is still felt as a serious drawback to the usefulness of the Institution. The trustees are preparing a proposal for consideration by the Government, which, if adopted, will provide a useful and permanent extension now urgently required, at a comparatively small cost. Catalogues, not only of the various collections in the Museum, but also of all branches of Australian zoology, are still in course of preparation. The following new publications have been issued during the past year:—"Catalogue of Hydroid Zoophytes"; "Catalogue of Echinodermata, Part I. Echini"; "Catalogue of Minerals." Catalogues of Sponges and Medusæ are in the printer's hands; and it is hoped that, by the liberality of the Government, the continuation of "Scott's Lepidoptera" will soon be commenced.

A TELEGRAM from Srinagar, Cashmere, states that a severe and prolonged earthquake was felt there early on the morning of the 20th inst. The damage caused is not yet known. Sharp shocks of earthquake were felt early on the morning of the 22nd at Charleston, Savannah, Augusta, Columbia, Orangeburg, Wilmington, North Carolina, and several other places. The first shock of earthquake was felt at 5 o'clock in the morning, and some sharp shocks followed at 3 o'clock in the afternoon. No damage is reported to have been done. A shock was felt at Louisville in the afternoon. The shocks of earthquake felt in the evening were more severe than any that have been experienced since the great earthquake of August 31. The shock was severely felt at Summerville, where some persons were thrown down and slightly injured. Several geysers have appeared in the neighbourhood of that town.

A CORRESPONDENT of the *Times* (October 21) who appears to have made a special study of Burmah, referring to the ethnology of that country, says that tradition points to three main streams of colonisation into Burmah. The northern sea-board, now known as Aracan, is said to have received its earliest population and polity from the Buddhist kingdoms of Bengal. The southern sea-board, or Pegu, with Rangoon as its modern capital, is supposed to owe its civilisation to settlers who crossed the sea from the Madras coast. The ancient kings of the inner country, which we call Upper Burmah, also claimed an Indian affinity. But, as a matter of fact, they and their people poured across the mountains and down the river valleys from the confines of China and Mongolia. These three prehistoric divisions have left their mark on the political geography of Burmah at the present day. Each of them has in turn advanced upon and crushed its neighbours, while the whole has been from time to time submerged by fresh avalanches of wild races from the north and east.

NEXT March the railway from Oran to Tunis *viâ* Algiers and Constantine, will be completed, and will be between 800 and 900 miles long.

WE have received from Messrs. Goolden and Trotter a small illustrated pamphlet descriptive of their dynamos, which appear to be well-designed modifications of the familiar Gramme machine, lamps, and other appliances for electric light. The pamphlet is also a price-list, and though with the latter feature we have nothing to do, we may remark on a curious and scientific innovation in stating the price of dynamos in a mathematical relation to their output, being, in fact, stated as 8*l.* 10*s.* per 1000 watts plus a constant of 25*l.* Trotter's dioptric shades, which are another speciality of this house, are an example of a great improvement effected in a common manufacture by the application of good geometrical and optical principles, and we have pleasure in noticing them on this account.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mrs. H. Reader; two Green Monkeys (*Cercopithecus callitrichus* ♂ ♀) from West Africa, presented respectively by Mr. J. W. Bacon and Mr. G. D. W. Ingham; a Canadian Beaver (*Castor canadensis* ♀) from Canada, presented by the Earl of Carnarvon; a Crested Porcupine (*Hystrix cristata* ♀) from Ceylon, presented by Mrs. E. Dunn; a Grey Seal (*Halichœrus grypus* ♀) from the North Atlantic, presented by Mr. H. Overton; a Quail (*Coturnix communis*), an Asiatic Quail (*Perdicula asiatica*) from India, presented by Dr. A. Günther, F.Z.S.; a Pig-tailed Monkey (*Macacus nemestrinus* ♂) from Java, six Mute Swans (*Cygnus olor*), a Cormorant (*Phalacrocorax carbo*), British, deposited; a Scarlet Ibis (*Eudocimus ruber*), a Common Boa (*Boa constrictor*) from South America, received in exchange; a Vulpine Phalanger (*Phalangista vulpina*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE DISTRIBUTION OF THE STARS IN SCHÖNFELD'S "DURCHMUSTERUNG."—The extension of Argelander's survey of the heavens from the North Pole to 2° of south declination undertaken by his successor, Prof. Schönfeld, has recently been published, and contains the places of stars down to mag. 10, situated between 2° and 23° of south declination. Prof. Seeliger, in a paper entitled "Ueber die Vertheilung der Sterne auf der Südlichen Halbkugel nach Schönfeld's 'Durchmusterung,'" published in the *Proceedings* of the Mathematico-Physical Section of the Bavarian Academy of Sciences, has discussed the question of the distribution of these stars. He divides the stars into eight classes. Class I. contains those of mag. 1–6·5, Class II. those of mag. 6·6–7·0, and so on down to Class VIII., which contains stars of mag. 9·6–10·0. Prof. Seeliger then gives the number of stars in each class arranged in zones embracing 1° in declination, and grouped by intervals of 40m. in R.A. The totals for each class are: Class I. 1265, Class II. 1276, Class III. 1828, Class IV. 3516, Class V. 7601, Class VI. 18,633, Class VII. 55,565, and Class VIII. 43,896. The total number of stars thus counted is 133,580, and adding to this 79 objects which are classified as nebulæ or variables, there results the grand total 133,659. This total agrees with the summation of the numbers given by Prof. Schönfeld. Comparing the results contained in this paper with those in a similar paper on the stars in Argelander's "Durchmusterung," Prof. Seeliger finds that, as far as Schönfeld's work can be considered typical of the southern hemisphere as a whole (it must be remembered, however, that it only embraces one-third thereof), the influence of the Milky Way on stellar distribution, at least for stars down to mag. 8, appears to be less marked for the southern than for the northern hemisphere. With regard to the question as to which hemisphere is the richer in stars, it appears that there is no decided difference shown by the two surveys under consideration. Reducing Argelander's numbers so as to make them comparable with Schönfeld's, and taking stars down to mag. 9 inclusive, we have for the former the total 34,324, and for the latter 34,119, a difference which may reasonably be attributed to accidental circumstances.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 OCTOBER 31—NOVEMBER 6

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)